Patent Claims

1. A method for optimizing the action of the engine brake in a drive unit (1), in particular for application in motor vehicles

- with an internal combustion engine (3) comprising a crankshaft (4);

- with an exhaust gas turbine (5), which is disposed in the exhaust gas flow (7) of the internal combustion engine (3) for the conversion of exhaust gas energy into drive energy;

- the exhaust gas turbine (5) is connected to the crankshaft (4) via a transfer device (16);

- a hydrodynamic coupling (8) comprising a primary wheel (10) and a secondary wheel (9) is disposed in the transfer device (16),

wherein the secondary wheel (9) is coupled with the crankshaft (4) and the primary wheel (10) is coupled with the exhaust gas turbine (5), at least indirectly;

characterized by the following features:

1.1 in which, in an operating state that corresponds to the braking operation with the engine brake, the exhaust gas turbine (5) is operated at a working point (II), which is characterized by a maximum acceptable limiting speed n_{max-5} of exhaust gas turbine (5) with a minimum outputtable moment M_5 and

1.2 in an operating state that corresponds to partial load operation or thrust operation, the exhaust gas turbine (5) is operated at a working point (I), which is characterized by a minimum speed n_{min-5} and a minimum receivable moment M_{min-5}, whereby the adjusting of both working points is conducted via the hydrodynamic coupling (8), which is designed in such a way that it is suitably operated in accordance with at least one characteristic curve whose transferable moment over most of the speed difference that characterizes the slip

21

range, taking into consideration the gear ratio or multiplication of the transfer elements in the transfer device (16) relative to exhaust gas turbine (5), corresponds to the minimum moment $M_{min\text{-}5}$ that can be output or received by exhaust gas turbine (5).

2. The method according to claim 1, further characterized in that a hydrodynamic coupling (8) with a constant filling [ratio] FG is used, whose characteristic for this filling ratio FG is characterized by a moment course, which lies, over most of the slip range, in the region of the minimum moment $M_{min\text{-}5}$ that can be received or output by the exhaust gas turbine (5), taking into consideration the gear ratio or multiplication in the transfer device (16).

3. The method according to claim 1, further characterized in that a hydrodynamic coupling (8) is used, whose filling ratio FG can be controlled in a closed loop and/or regulated in an open loop.

4. The method according to claim 3, further characterized in that the closed-loop control and/or open-loop regulation of the filling ratio FG takes place as a function of at least one of the following values:
- Pressure at an inlet (17) into the working chamber (11) of the hydrodynamic coupling (8) and/or at an outlet (18) from the working chamber (11) of the hydrodynamic coupling (8)
 - Pressure difference (Δp) between inlet (17) and outlet (18) from the working chamber (11)
- Volumetric flow at the inlet (17) and/or outlet (18) from the working chamber (11)
- Quantities of working medium discharged by means of mechanical units, for example scoop tubes.

5. The method according to one of claims 1 to 4, further characterized in that working points (I, II) are adjusted by closed-loop control of the speed n_5 or a value of the exhaust gas turbine (5) that characterizes this speed, at least indirectly.

6. The method according to one of claims 1 to 4, further characterized in that working points (I, II) are adjusted by open-loop regulation of the speed n_5 or a value of the exhaust gas turbine (5) that characterizes this speed, at least indirectly.

7. The method according to claim 6, which is further characterized in that a value that characterizes the actual speed of the exhaust gas turbine (5) at least indirectly is continuously determined and is compared with the set speed n_{set-5} that is to be adjusted, whereby a set value for controlling the hydrodynamic coupling (8) is given in advance as a function of the regulated deviation.

8. The method according to one of claims 1 to 7, further characterized in that the operating state of braking operation with the engine brake is detected in the presence of a speed n_5 of the exhaust gas turbine that is greater than the speed of the crankshaft (4) taking into consideration the gear ratio or multiplication in the transfer device (16), while the partial load operation or thrust operation is detected in the presence of a speed n_5 in the exhaust gas turbine (5), again taking into consideration the multiplication in the transfer device (16), that is smaller than the speed n_4 of the crankshaft (4), excluding full-load operation.

23

9. A driveline (1)

- with an internal combustion engine (3) comprising a crankshaft (4);

- with an exhaust gas turbine (5), which is disposed in the exhaust gas flow (7) of the internal combustion engine (3) for the conversion of exhaust gas energy and drive energy;

- the exhaust gas turbine (5) is connected to the crankshaft (4) via a transfer device (16);

- a hydrodynamic coupling (8) comprising a primary wheel (10) and a secondary wheel (9) is disposed in the transfer device (16), wherein the secondary wheel (9) is coupled with the crankshaft (4) and the primary wheel (10) is coupled with the exhaust gas turbine (5), at least indirectly;

is hereby characterized in that the hydrodynamic coupling (8) is designed in such a way that it is suitably operated at least corresponding to a characteristic whose transferable moment, taking into consideration the gear ratio or multiplication in the transfer device (16), corresponds to the minimum moment M_{min-5} that can be received or output by exhaust gas turbine (5) over a major part of the slip range characterized by the speed ratio between primary wheel and secondary wheel.

10. The drive unit (1) according to claim 9, further characterized by the following features:

10.1 the hydrodynamic coupling (8) is designed as a closed-loop controllable or open-loop regulatable coupling with variable filling ratio;

10.2 with a control device (20), which is assigned to the hydrodynamic coupling (8) and comprises a setting device for forming the set value for the control of a setting device (22) of the hydrodynamic coupling (8).